

Atty. Docket No.: ALPH.P014

Patent Application 09/990,847

IN THE CLAIMS

Please amend the claims as indicated below.

1 1. (currently amended) A method for generating a pulsed excitation function
2 representative of a human vocal tract, comprising:
3 receiving movement information of at least one tissue type associated with human
4 voicing activity, wherein the movement information comprises position versus time
5 information, wherein the at least one tissue type includes human vocal tract tissue that
6 vibrates with opening and closing of vocal folds;
7 generating pressure-related information using at least one derivative of the movement
8 information;
9 identifying opening times and closing times of the vocal folds using the pressure-
10 related information;
11 constructing the pulsed excitation function by generating a curve including negative
12 amplitude-pulses at times corresponding to the closing times of the vocal folds and positive
13 amplitude- opposite polarity pulses at times corresponding to the opening times of the vocal
14 folds; and
15 adjusting amplitudes and widths of the negative-amplitude-and-positive-amplitude
16 opening and closing pulses to match speech output of the human vocal tract.

1 2. (currently amended) The method of claim 1, further comprising:
2 determining parameters of the human vocal tract tissue by applying a simple harmonic
3 oscillator model to the constructed pulsed excitation function, wherein the parameters include
4 mass, elasticity, and damping; and
5 constructing a model of the human vocal tract tissue using the parameters.

1 3. (currently amended) The method of claim 1, further comprising determining
2 voiced speech parameters using the constructed pulsed excitation function, wherein the
3 human speech parameters include voiced excitation functions, voicing states, pitch periods,

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4 vocal tract transfer functions, ~~and~~-tracheal wall parameters, and the pressure-related
5 information.

1 4. (new) The method of claim 2, further comprising using an adaptive algorithm
2 to select optimal values for pulse amplitude and width parameters, and parameters of the
3 simple harmonic oscillator model.

1 5. (new) The method of claim 1, further comprising:
2 receiving a signal representative of movement of a human vocal tract, including a
3 glottal-area electromagnetic micropower sensor (GEMS) signal;
4 generating at least one of a first derivative and a second derivative of the GEMS
5 signal;
6 identifying all peaks of the first derivative and zero crossings of the second derivative
7 of the GEMS signal;
8 determining pulse locations using at least one of the peaks and zero crossings.

1 6. (new) The method of claim 5, further comprising placing pulses having a
2 desired amplitude and width at the determined pulse points.

1 7. (new) The method of claim 6, wherein the desired amplitude and width are
2 determined using at least one process selected from a group comprising, trial and error
3 processes, and adaptive processes.

1 8. (new) The method of claim 1, further comprising determining parameters of
2 the human vocal tract tissue, including:
3 applying a mathematical model to the pulsed excitation function, wherein the
4 mathematical model comprises at least a simple harmonic oscillator model, to generate an
5 output signal that simulates the movement of the human vocal tract during speech production;
6 comparing the output of the mathematical model to the original signal representative
7 of movement of a human vocal tract used to calculate the pulsed excitation function;

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8 generating corrected parameters using at least one of a trial and error method and an
9 adaptive function that utilizes the output of the mathematical model and the original signal
10 representative of movement of a human vocal tract used to calculate the pulsed excitation
11 function.

1 9. (new) A system for calculating a plurality of human speech parameters,
2 comprising:
3 a plurality of microphones;
4 at least one sensor for detecting movement information of at least one tissue type
5 associated with human voicing activity; and
6 a processor coupled to the plurality of microphones and to the at least one sensor,
7 wherein the processor is configured to execute a plurality of algorithms including at least one
8 algorithm for generating a pulsed excitation function, wherein generating the pulsed
9 excitation function comprises,
10 generating pressure-related information using at least one derivative of the
11 movement information;
12 identifying opening times and closing times of the vocal folds using the
13 pressure-related information; and
14 constructing the pulsed excitation function by generating a curve including
15 folds-closing pulses at times corresponding to the closing times and opposite polarity folds-
16 opening pulses at times corresponding to the opening times.

1 10. (new) The system of claim 9, wherein at least one algorithm further comprises
2 a noise suppression algorithm and a speech feature extraction algorithm.

1 11. (new) The system of claim 9, wherein generating the pulsed excitation
2 function further comprises adjusting amplitudes and widths of the folds-closing and folds-
3 opening pulses to match speech output of the human vocal tract.

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1 12. (new) The system of claim 9, wherein the movement information comprises
2 position versus time information, wherein the at least one tissue type includes human tissue
3 that vibrates with opening and closing of vocal folds, and wherein the movement can in
4 include vocal fold movement.

1 13. (new) The method of claim 9, wherein the processor is further configured to:
2 determine human vocal tract tissue parameters by applying a simple harmonic
3 oscillator model to the constructed pulsed excitation function, wherein the parameters include
4 mass, elasticity, and damping; and
5 construct a model of the human vocal tract tissue using the parameters.

1 14. (new) The method of claim 1, wherein the human speech parameters include
2 voiced excitation functions, voicing states, pitch periods, vocal tract transfer functions, the
3 pressure-related information, and tracheal wall parameters.

1 15. (new) A computer-readable medium having instruction stored thereon, which
2 when executed, cause a processor to calculate a plurality of human speech parameters,
3 wherein calculating comprises:
4 receiving movement information of at least one tissue type associated with human
5 voicing activity, wherein the movement information comprises position versus time
6 information, wherein the at least one tissue type includes human tissue that vibrates with
7 opening and closing of vocal folds;
8 generating pressure-related information using at least one derivative of the movement
9 information;
10 identifying opening times and closing times of the vocal folds using the pressure-
11 related information;
12 constructing the pulsed excitation function by generating a curve including folds-
13 closing pulses at times corresponding to the closing times and opposite polarity folds-opening
14 pulses at times corresponding to the opening times; and

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15 adjusting amplitudes and widths of the folds-closing and folds-opening pulses to
16 match speech output of the human vocal tract.

1 16. (new) The computer-readable medium of claim 15, wherein calculating the
2 plurality of human speech parameters further includes calculating a transfer function of the
3 vocal tract using at least one of the pulsed excitation function, the pulsed excitation function
4 as filtered by a simple harmonic oscillator model of a vocal tract, and a glottal-area
5 electromagnetic micropower sensor (GEMS) signal as input, and recorded audio as output of
6 a vocal tract model.

1 17. (new) The computer-readable medium of claim 15, wherein calculating the
2 plurality of human speech parameters further includes:
3 determining parameters of the human vocal tract by applying a simple harmonic
4 oscillator model to the constructed pulsed excitation function, wherein the parameters include
5 mass, elasticity, and damping; and
6 constructing a model of the human vocal tract using the parameters.

1 18. (new) The computer-readable medium of claim 15, wherein calculating the
2 plurality of human speech parameters further includes determining voiced speech parameters
3 using the constructed pulsed excitation function, wherein the human speech parameters
4 include voiced excitation functions, voicing states, pitch periods, vocal tract transfer
5 functions, the pressure-related information, and tracheal wall parameters.

1 19. (new) The computer-readable medium of claim 17, wherein calculating the
2 plurality of human speech parameters further includes using an adaptive algorithm to select
3 optimal values for pulse amplitude and width parameters, and parameters of the simple
4 harmonic oscillator model.

1 20. (new) The computer-readable medium of claim 15, wherein calculating the
2 plurality of human speech parameters further includes:

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3 receiving glottal-area electromagnetic micropower sensor (GEMS) signal;
4 generating at least one of a first derivative and a second derivative of the GEMS
5 signal;
6 identifying all zero crossings of a raised version of the GEMS signal;
7 determining pulse locations using the zero crossings.

1 21. (new) The computer-readable medium of claim 20, wherein calculating the
2 plurality of human speech parameters further includes placing pulses having a desired
3 amplitude and width at the determined pulse points.

1 22. (new) The computer-readable medium of claim 21, wherein the desired
2 amplitude and width are determined using at least one process selected from a group
3 comprising, trial and error processes, and adaptive processes.

1 23. (new) The computer-readable medium of claim 15, wherein calculating the
2 plurality of human speech parameters further includes determining parameters of the human
3 vocal tract, including:
4 applying a mathematical model to the pulsed excitation function, wherein the
5 mathematical model comprises at least a simple harmonic oscillator model, to generate an
6 output signal that simulates the movement of the human vocal tract during speech production;
7 comparing the output of the mathematical model to the original signal representative
8 of movement of a human vocal tract used to calculate the pulsed excitation function;
9 generating corrected parameters using at least one of a trial and error method and an
10 adaptive function that utilizes the output of the mathematical model and the original signal
11 representative of movement of a human vocal tract used to calculate the pulsed excitation
12 function.